LA-UR-17-29227
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Title: Parallel Computing Summer Research Internship

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Intended for: Recruitment slide deck

Issued: 2017-10-10

Parallel Computing Summer Research Internship

Creates **next-generation leaders** in **HPC research** and **applications development**

2018 Applications Opens

http://parallelcomputing.lanl.gov

June 4 – August 10, 2018

PCSRI Leads: Bob Robey (XCP-2), Hai Ah Nam (CCS-2), Kris Garrett (CCS-2)

Operated by Los Alamos National Security, LLC for the U.S. Department of Energy's NNSA

PCSRI Goals

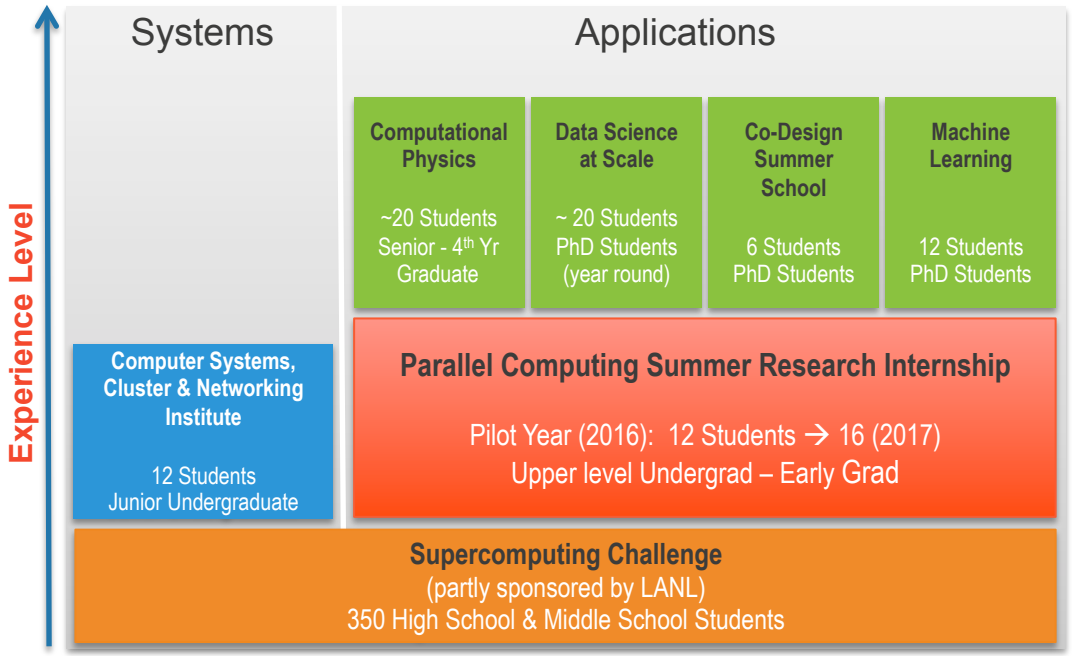


Figure 1: LANL HPC/Computing Student Pipeline by experience level and topic area.

- **TRAINING NEXT GENERATION**
  - Provide solid HPC education
  - Explore algorithms, methods and technologies based on architectural features
  - Instill good software development practices
- **DEVELOP COLLABORATION SKILLS**
  - Create a common language and break down barriers from science domain to hardware
- **ESTABLISH NEW PIPELINE FOR LANL & OTHER PROGRAMS**
  - Over half of staff historically have started in student programs

Needed NOW more than ever

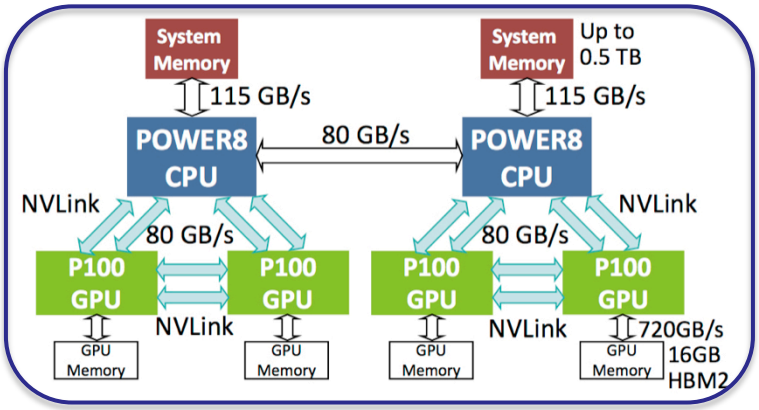
HPC is increasing in complexity

On-Node Parallelism

Affinity

In-Situ Visualization

CPUs + GPUs



Many-Core

EXASCALE

Asynchronous Task-Based

Memory Hierarchy

Performance Portability

Profiling

Schedulers – SLURM

Threading + Scoping

Vectorization

Compiler Bugs

Parallel Computing SRI

ISTI

NSEC National Security Education Center

Three Phases of PCSRI

Real-World Computing Resources

- Darwin in CCS @ LANL
  - KNL, Broadwell, Haswell, Sandybridge, GPUs, IBM Power8 + P100, etc.
- LANL Institutional Computing
  - Grizzly (Broadwell), Wolf (Sandybridge)
- LANL ASC Computing
  - Trinitite (Haswell + Knights Landing)
- NSF & NCSA
  - Bluewaters – Cray XE6 + XK7 (K20 GPU)
- NERSC
  - Cori (Intel Haswell + Knights Landing)

Compute-time allocations via proposal

Leadership/Organization: It Takes a Community

Co-Leads

Bob Robey
XCP-2

Hai Ah Nam
CCS-2

Kris Garrett
CCS-2

Joe Schoonover
CCS-2 (formerly)
VACANCY

Mentors

Neil Carlson (CCS-2)
Hai Ah Nam (CCS-2)
Garrett Kenyon (CCS-3)
Cristina Garcia Cardona (CCS-3)

Stefano Gandolfi (T-2)
Brendt Wohlberg (T-5)

Bob Robey (XCP-2)
Jesse Canfield (XCP-4)

Youzuo Lin (EES-17)
Eunmo Koo (EES-16)

Laura Monroe (HPC-DES)

Guest Lecturers

Bill Archer (ADX)
Galen Shipman (CCS-7)
Ryan Braithwaite (CCS-7)
Scott Pakin (CCS-7)
Rob Cunningham (HPC)
David Rogers (CCS-7)
Jennifer Estrada (ISR)
Ron Green (CCS-7)
Brendan Krueger (XCP-2)
KT Thompson (CCS-2)
Angela Herring (XCP-1)
Doug Jacobsen (Intel)
John Levesque (Cray)

Workshop Coordinator
Nickole Aguilar Garcia

ISTI Director – Stephan Eidenbenz

THANK YOU!

Parallel Computing SRI

ISTI

NSEC National Security Education Center

2017 Students: 16 Brave & Diverse Souls

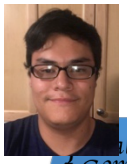
Robert Martin-Short
Geophysics, PhD
UC Berkeley

Alonso Navarro
Computational Science MS
San Diego State University

Justin Sunu
Computational Science PhD
SDSU/Claremont Graduate U

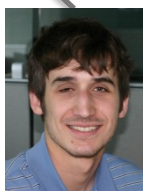
Jordan Fox
Computational Science PhD
SDSU/Claremont Graduate U

Kirtus Leyba
Astrophysics, BS+0
Arizona State University



Donald Kruse
Applied Math & CS, BS+0
UNM

Nils Carlson
Math & CS, BS
New Mexico Tech

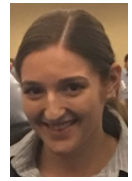


William Rosenberger
CS, BS+0
New Mexico Tech

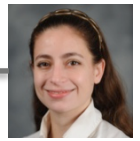
Siddhartha Bishnu
Physical Oceanograpy MS
Florida State University

Trokon Johnson
Computer Eng, PhD
University of Florida

Jacob Carroll
Physics PhD
Virginia Tech



Jennifer Soter
Physics, BS
Drew University



Rachel LeCover
Chemical Eng, PhD
Cornell University

Prerna Patil
Fluid & Thermals Sciences, PhD
University of Pittsburgh

Brian Kaiser
Physical Oceanography, PhD (MIT)

2017 PCSRI Student Research Projects

- **Asynchronous Dictionary Learning for Remote Sensing Imagery Classification**
  Prerna Patil (Brown), Kirtus Leyba (UNM); Mentors: Youzuo Lin (EES-17)
- **Phase Transitions in Sparsely Coded Neural Networks**
  Jacob Carroll (Virginia Tech), Nils Carlson (NM Tech); Mentor: Garrett Kenyon (CCS-3)
- **Towards Parallelized Dictionary Learning and Sparse Coding**
  Trokon Johnson (U of Florida), Rachel LeCover (Cornell); Mentors: Brendt Wohlberg (T-5), Cristina Garcia Cardona (CCS-3)
- **Parallelization of Volume of Fluid Algorithms on Unstructured Meshes**
  Justin Sunu (CGU), Alonso Navarro (SDSU), Donald Kruse (UNM); Mentor: Neil Carlson (CCS-2)
- **Parallel Calculation of the Radiation View Factor Matrix using Charm++**
  William Rosenberger (UNM); Mentor: Neil Carlson (CCS-2)
- **Developing an efficient particle transport routine for the HIGRAD fluid dynamics software**
  Robert-Martin Short (UC Berkeley); Mentors: Eunmo Koo (EES-16), Bob Robey (XCP-2)
- **Hydrodynamic Instability in Inertial Confinement Fusion**
  Bryan Kaiser (MIT); Mentor: Jesse Canfield (XCP-4)
- **Quantum Monte Carlo with OpenMP 4.0+ for Performance Portability**
  Jordan Fox (SDSU), Jenny Soter (Drew University); Mentors: Stefano Gandolfi (T-2), Hai Ah Nam (CCS-2)
- **Thoughtful Precision in Mini-Apps**
  Siddhartha Bishnu (Florida State University), Shane Fogerty (U of Rochester); Mentors: Laura Monroe (HPC-DES), Bob Robey (XCP-2)

Overlap Parallel Computing with Machine Learning

2018 Applications Open

- http://parallelcomputing.lanl.gov

- Upper division undergraduate students and early graduate students in all scientific disciplines are encouraged to apply. Students must be enrolled in an accredited U.S. university and in good academic standing and maintain a GPA of 3.0/4.0 or better.
  - Letter of Intent
  - CV
  - Unofficial transcript

- **Due January 26, 2018**